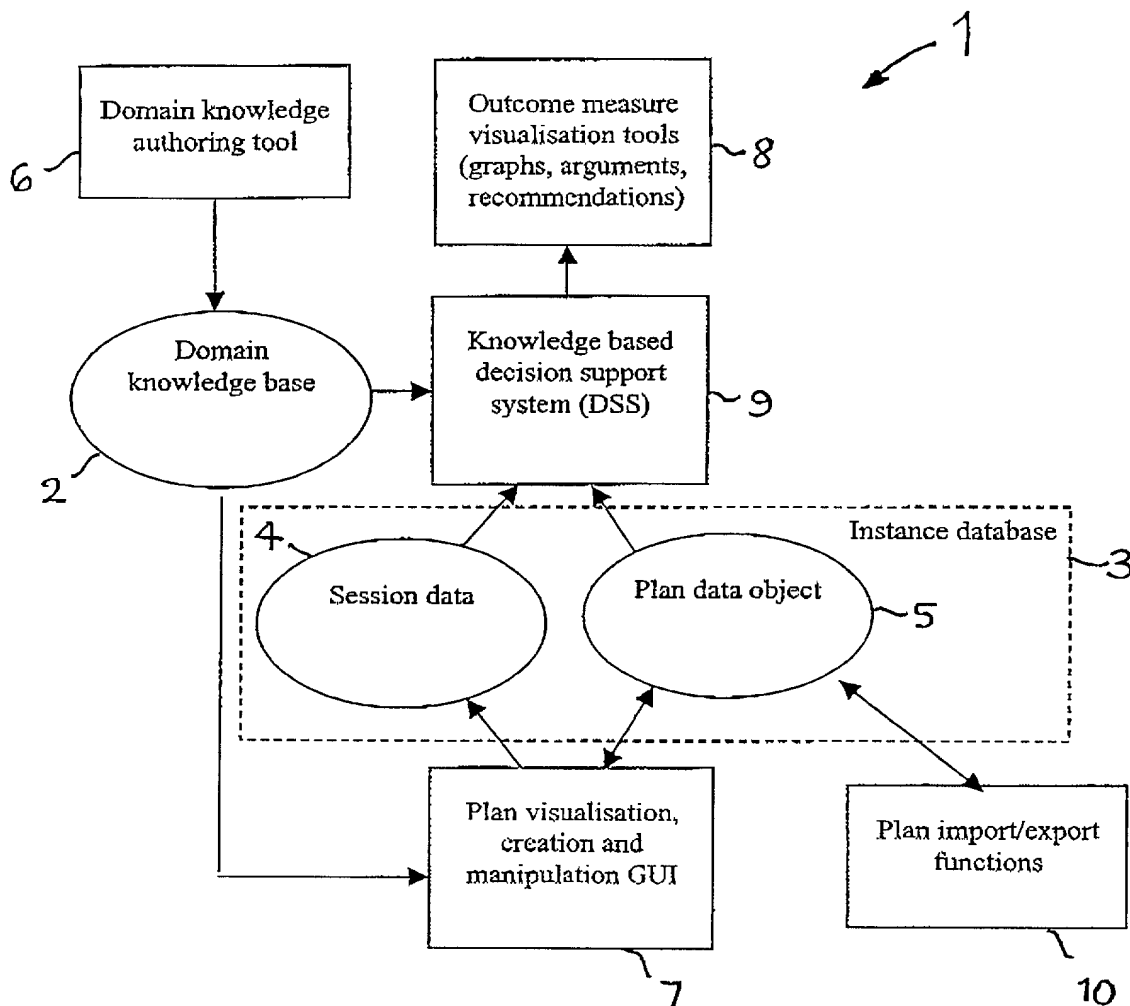*Figure 1. General structure of the invention Ellipses indicate data objects, rectangles indicate processes acting on data, and arrows indicate the direction of data flow.*

(a)   Action/event type definition   21

21a → Name
21b → Extent (instantaneous or extended)
21c → Type (Event, action, decision, enquiry)
21d → Arguments/conflicts   ● →
21e → Next action/event type definition   ● ▼

(b)   Argument/conflict definition   22

22a → Name
22b → Type (argument/conflict)
22c → Qualifier
22d → Conditions defined in terms of: 1. Instance data definitions 2. Action/event type definitions 3. Standard arithmetic and logical operations plus temporal operators ("occurs before", "occurs during", "occurs within 5 days of" etc.)
22e → Next argument/conflict definition   ● ▼

(c)   Instance data item definition   23

23a → Name
23b → Storage type (string, integer, real, boolean etc.)
23c → Range
23d → Source (enquiry, database)
23e → Next instance data object definition   ● →

(d)   Outcome measure definition   24

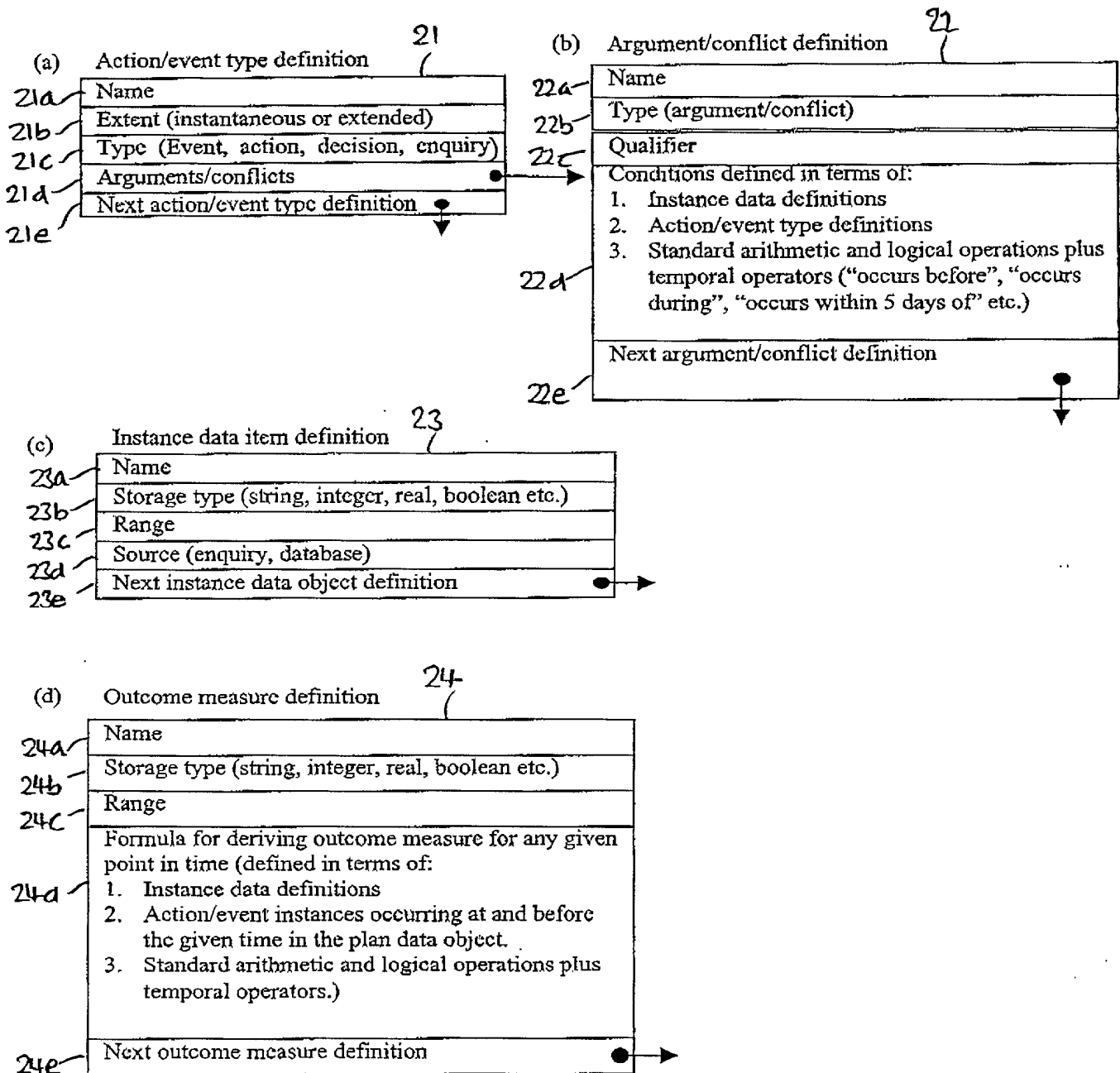| |
|---|
| **24a** → Name |
| **24b** → Storage type (string, integer, real, boolean etc.) |
| **24c** → Range |
| **24d** → Formula for deriving outcome measure for any given point in time (defined in terms of:
1. Instance data definitions
2. Action/event instances occurring at and before the given time in the plan data object.
3. Standard arithmetic and logical operations plus temporal operators.) |
| **24e** → Next outcome measure definition   ● → |

Figure 2: Data structures comprising the domain knowledge base. (a) Definition of action or event type, including a pointer to a list of argument or conflict definitions of which one is shown in (b). A linked list of instance data item definitions (c) define the information which may be held in the instance data base for instances within the domain being defined. Examples of such data would be the age, sex and medical history of a patient within a medical planning domain, for example. A linked list of outcome measure definitions (d) define outcome measures applicable to the domain along with the functions for their derivation from domain and instance data.
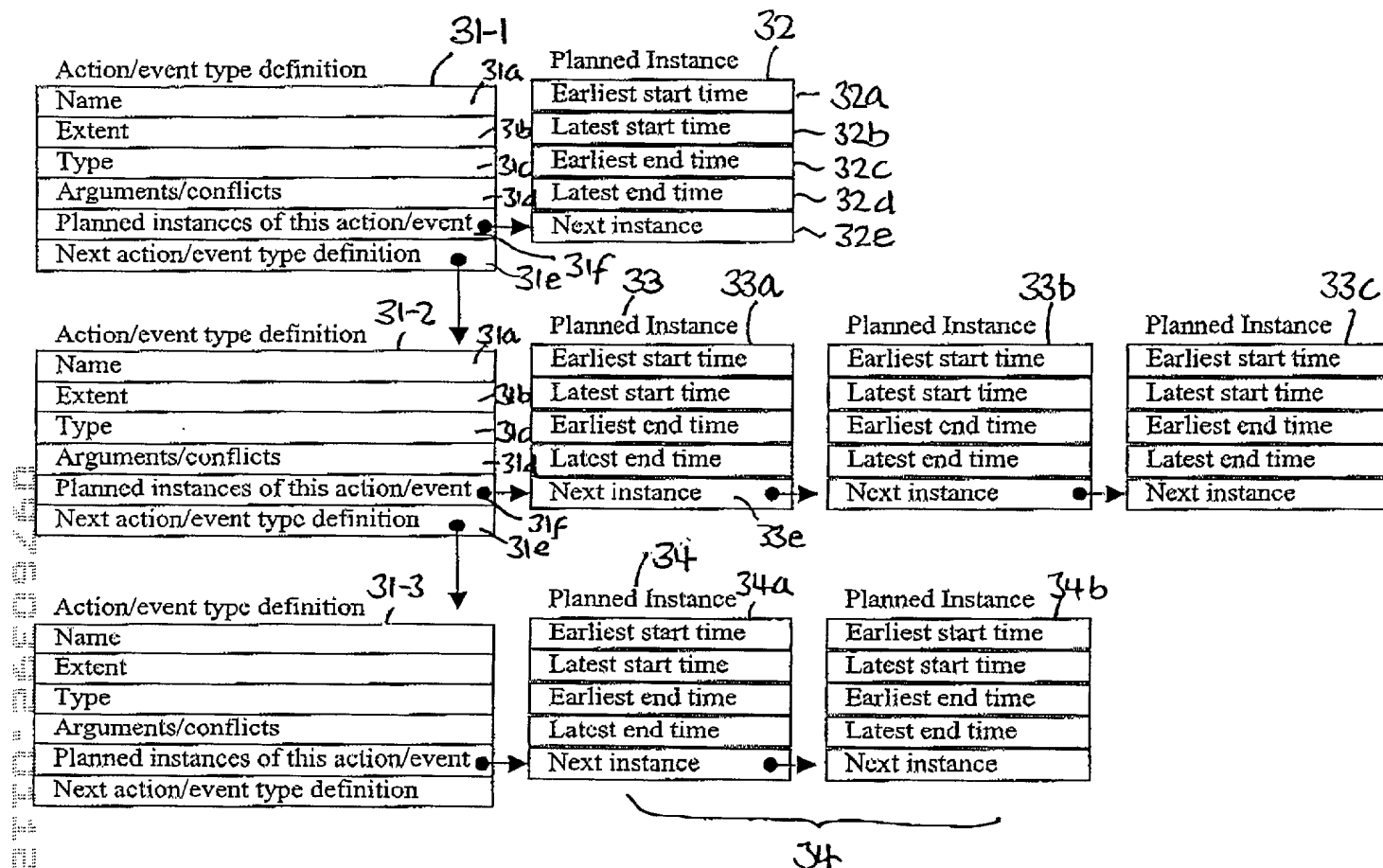
31-1

32

Action/event type definition **31a**

| Name |
| Extent | **31b**
| Type | **31c**
| Arguments/conflicts | **31d**
| Planned instances of this action/event |
| Next action/event type definition |

31e 31f

Planned Instance **32**

Earliest start time	**32a**
Latest start time	**32b**
Earliest end time	**32c**
Latest end time	**32d**
Next instance	**32e**

33 **33a**   **33b**   **33c**

Action/event type definition **31-2**   **31a**

| Name |
| Extent | **31b**
| Type | **31d**
| Arguments/conflicts | **31d**
| Planned instances of this action/event |
| Next action/event type definition |

31f
31e

Planned Instance **33a**

| Earliest start time |
| Latest start time |
| Earliest end time |
| Latest end time |
| Next instance |

Planned Instance **33b**

| Earliest start time |
| Latest start time |
| Earliest end time |
| Latest end time |
| Next instance |

Planned Instance **33c**

| Earliest start time |
| Latest start time |
| Earliest end time |
| Latest end time |
| Next instance |

33e

34   **34a**

Action/event type definition **31-3**

| Name |
| Extent |
| Type |
| Arguments/conflicts |
| Planned instances of this action/event |
| Next action/event type definition |

Planned Instance **34a**

| Earliest start time |
| Latest start time |
| Earliest end time |
| Latest end time |
| Next instance |

Planned Instance **34b**

| Earliest start time |
| Latest start time |
| Earliest end time |
| Latest end time |
| Next instance |

34

Figure 3: The structure of the plan data object. The set of action/event type definition items defined in the domain knowledge base is structured as a linked list. Each is augmented with a pointer to a linked list list of planned instance items. Each planned instance item represents an instance of the corresponding event or action in the plan, and defines the start and end times for that instance.
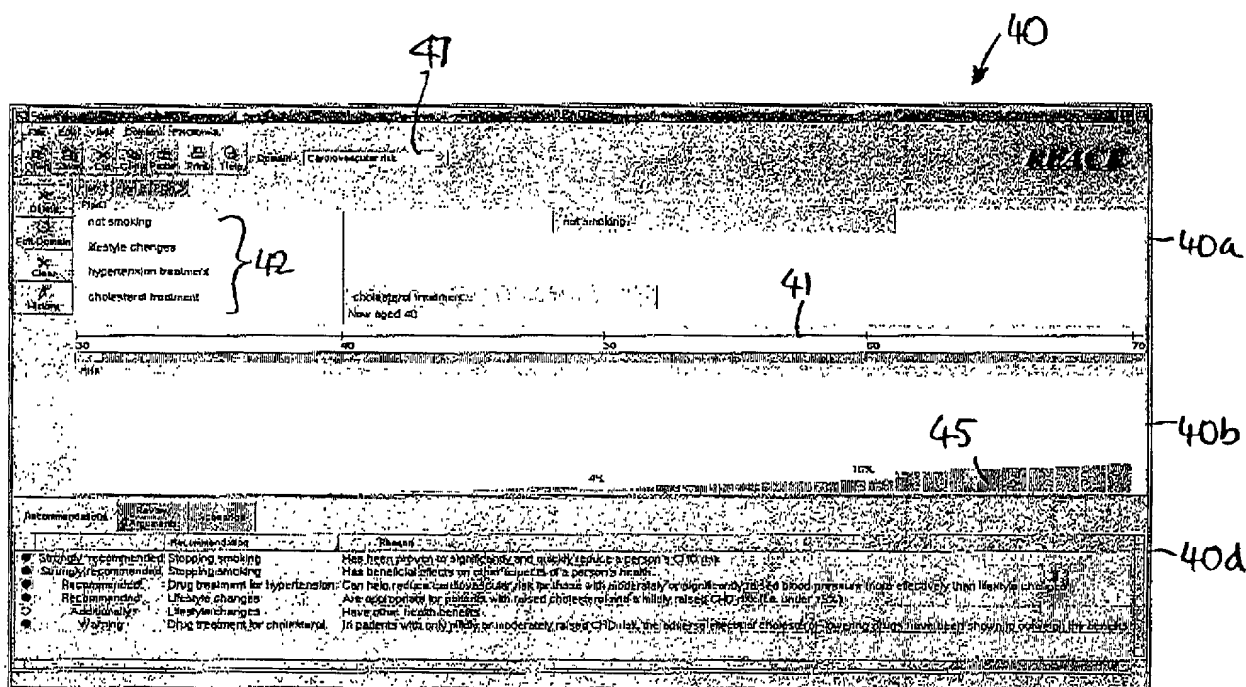
Figure 4. The REACT tool, here being used to investigate the consequences of medical interventions to reduce the risk of cardiovascular disease.
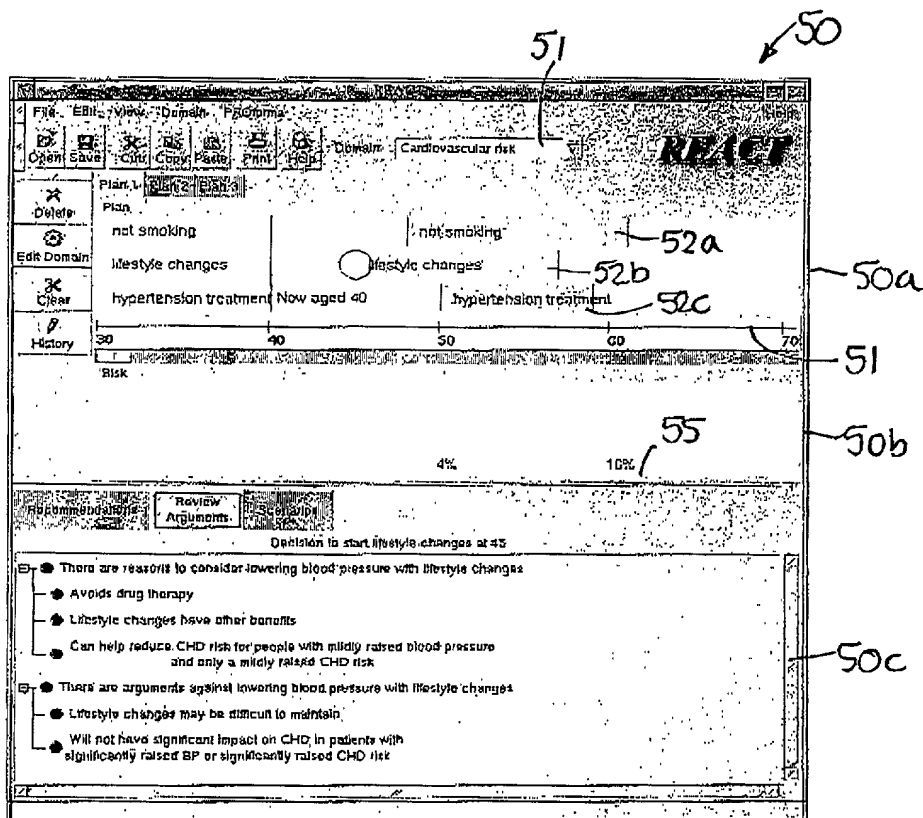

Figure 5. In the lower region of this image REACT displays arguments for and against the decision to manage risk of cardiovascular disease with lifestyle changes.
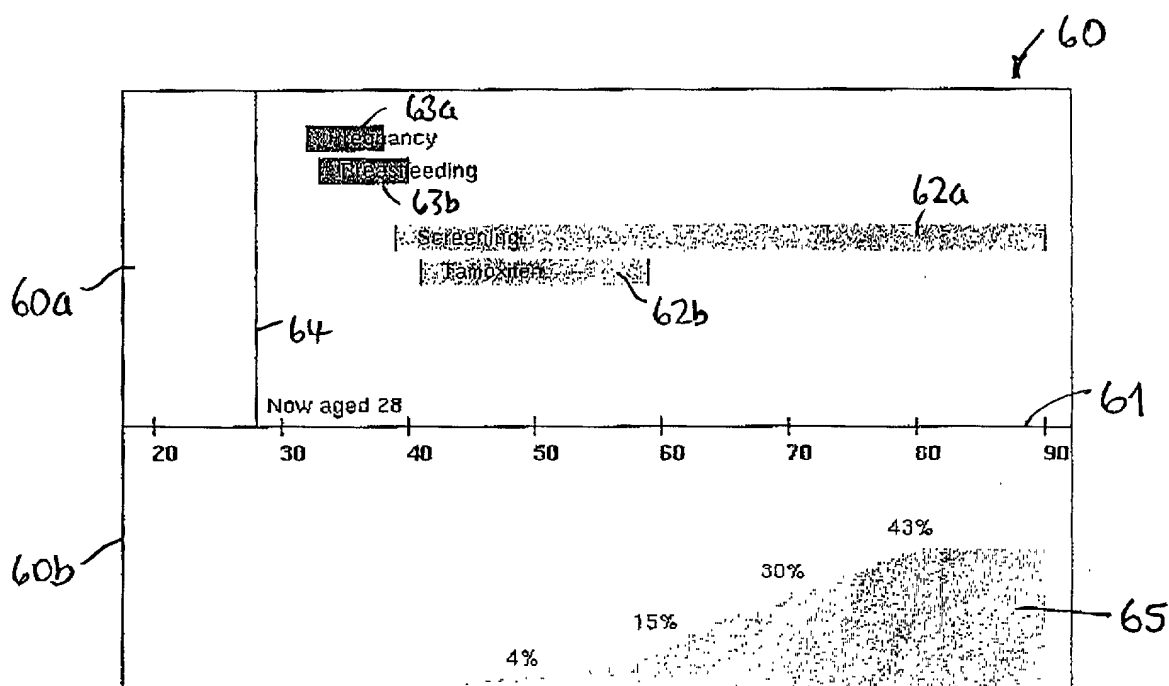
Figure 6. *REACT in use in a more complex domain, that of genetic susceptibility to breast cancer. A plan containing anticipated events (blue regions) and actions (green regions) is being constructed, and the pink graph shows projected risk of fatal cancer.*
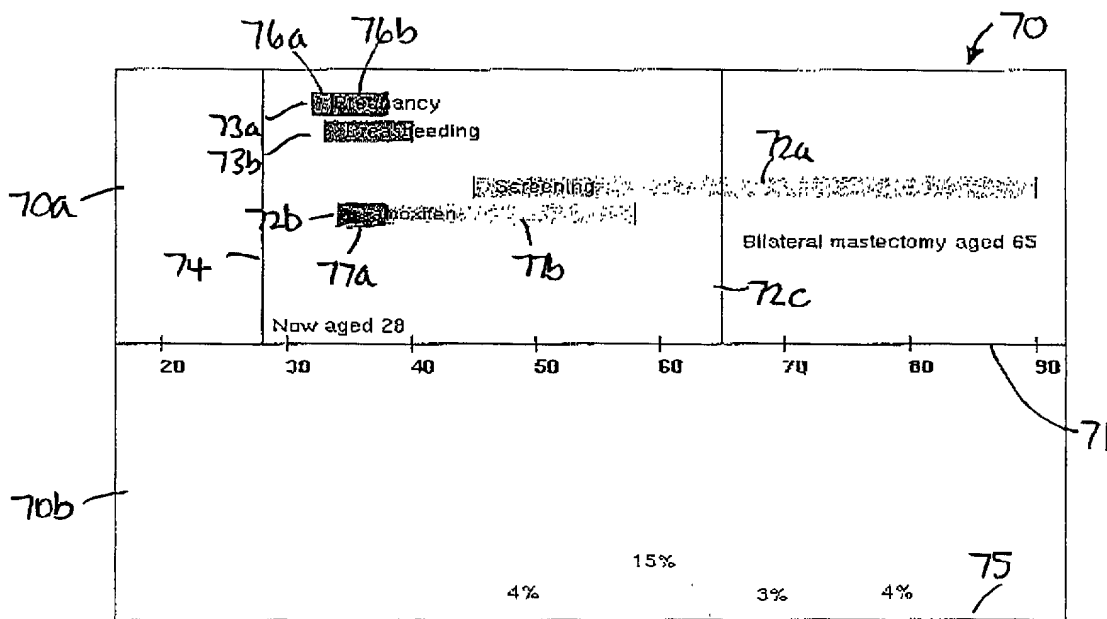
Figure 7. *Adding a planned surgical procedure (bilateral mastectomy) changes the projected risk profile. Extending tamoxifen drug treatment to coincide with pregnancy causes a conflict to be highlighted in red*
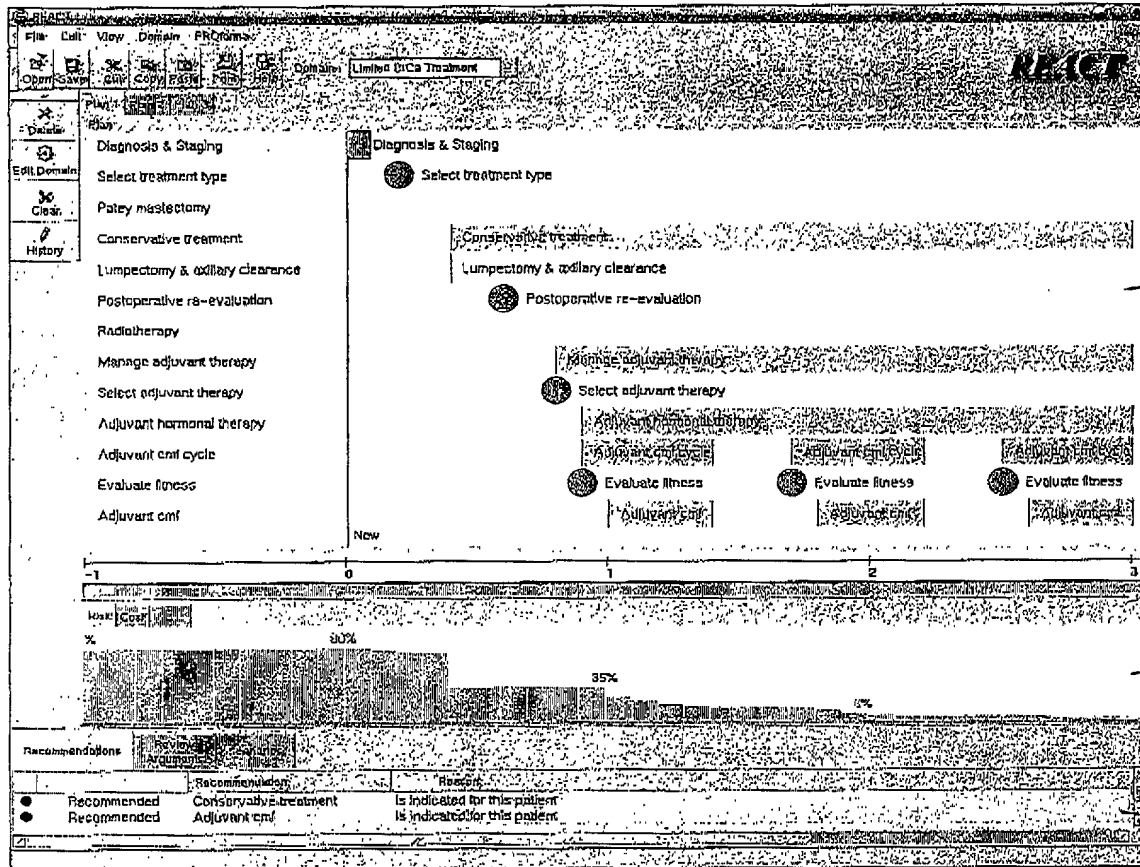
80

80a

80b

80d

Figure 8. An example of REACT use in planning treatment for an existing disease, rather than evaluating the risk of contracting a disease. Here a treatment plan is being constructed for a patient with limited breast cancer. An increased set of symbols is used here to distinguish different types of plan elements. Blue circles represent decisions that are planned to be taken during the treatment process. The plan shown represents only one of the possible ways in which these decisions may be taken, and thus one of a number of possible "routes" through the plan. The effect of this set of decisions may be compared with other plans in which the decisions are taken differently. The red square marked "Diagnosis and staging" represents a sub-plan, itself containing several actions and decisions, which may be opened in a separate window for modification if required.